GP 3641
#13 Response Letter 9/6/01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Examiner: E. Miller
Karabeyoglu, et al.	Group Art Unit: 3641
Serial No.: 09/505,516	San Francisco, CA 94111
Filed: February 17, 2000	
For: HIGH REGRESSION RATE HYBRID ROCKET PROPELLANTS AND METHOD OF SELECTING	Date: August 24, 2001

CERTIFICATE OF MAILING
I hereby certify that this correspondence is being sent via U.S. Mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231 on August 24, 2001.

Signed: Claudia Galik
Claudia Galik

TRANSMITTAL LETTER

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Please find enclosed the following documents relating to the above-identified patent application:

X Interview Summary; Figures A-J (10 sheets);
X Please charge any additional fees, including extension fees, or credit any overpayment to Deposit Account No. 06-1300 (Order No. A-67587-1/AJT/MSS).

Respectfully submitted,

By: Maria S. Swiatek
Maria S. Swiatek, Reg. No. 37,244

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A-67587-1/AJT/MSS
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INTERVIEW SUMMARY

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The following is a summary of an in-person interview conducted with Examiner Miller and the Applicant on July 26, 2001 at the U.S. Patent and Trademark Office. The Applicant participants in the interview were Drs. Brian Cantwell and Arif Karabeyoglu, both named inventors in the patent application, and Maria Swiatek, the Applicant's attorney of record. Applicant, and the participants, greatly appreciate the courtesy extended by Examiner Miller during the interview.

An Interview Summary, Form PTOL-413, has been provided by Examiner Miller. Applicant provides the following separate record of the substance of the interview to summarize the contents of a video demonstration of the invention shown during the interview.

A short video prepared by Applicant, showing a series of firing tests was viewed by Examiner Miller and the Applicant participants during the interview. The video was approximately five minutes in length, and showed eight primary firing tests or sequences performed in hybrid rocket systems, using the method of combusting of the present invention and conventional methods. Each of the eight firing sequences is described in detail below:

Test firing sequences 1 through 6 shown in the video were conducted at the Stanford lab hybrid rocket facility at the Aeronautics and Astronautics Department at Stanford University in Stanford, California. For each of the first six tests, an experimental bench top hybrid rocket apparatus was used, having a single port grain design as shown in Fig. 12b of the present patent application. The experimental conditions of the first four tests are shown in Table 1 on page 28 of the specification of the present patent application.

Test firing sequence 1 in the video showed the burning or combustion of plexiglass (PMMA) propellant, a conventional method and propellant. The experimental conditions of this test are shown in the Column marked PMMA (the third column from the left) of Table 1 on page 28 of the specification. The measured regression rate of this test was 0.028 cm/sec, as shown in Table 1. Figure A attached hereto is a still frame from the video showing the plume generated during combustion for this firing test sequence.

Test firing sequence 2 in the video showed the combustion of PE wax (a high molecular weight polyethylene wax), a conventional method and propellant. The experimental conditions of this test are shown in the Column marked PE wax (the forth column from the left) of Table 1 on page 28 of the specification. The measured regression rate of this test was 0.036 cm/sec, as shown in Table 1. Figure B attached hereto is a still frame from the video showing the plume generated during combustion for this firing test sequence.

Test firing sequence 3 in the video showed the combustion of Paraffin wax B, according to the method of combusting of the present invention (having a melting point of 67 C). The experimental conditions of this test are shown in the Column marked Paraffin wax B (the sixth, or rightmost, column from the left) of Table 1 on page 28 of the specification. The measured regression rate of this test was 0.100 cm/sec, as shown in Table 1. Figure C attached hereto is a still frame from the

video showing the plume generated during combustion for this firing test sequence. As shown in Figure C, the plume is much larger than that achieved with the conventional propellants.

Test firing sequence 4 in the video showed the combustion of Paraffin wax A, according to the method of the present invention (having a melting point of 61 C and a lower molecular weight than Paraffin wax B). The experimental conditions of this test are shown in the Column marked Paraffin wax A (the fifth column from the left) of Table 1 on page 28 of the specification. The measured regression rate of this test was 0.114 cm/sec, as shown in Table 1. Figure D attached hereto is a still frame from the video showing the plume generated during combustion for this firing test sequence. As shown in Figure D, the plume is much larger than that achieved with the conventional propellants, and slightly longer than in the test sequence 3 image consistent with the higher regression rate.

Note that the oxidizer flow rate and initial port diameter is the same for the test sequences 1 through 4 above as shown in Table 1 on page 28 of the specification. The port length was the same for test sequences 2 to 4, but different for test sequence 1. The lowest regression rate fuel (in test sequence 1) requires a longer port to provide proper ignition of the motor and combustion. The photos of Figures A to D graphically illustrate the higher burning rate achieved by the method of the present invention as compared to the conventional methods.

Test firing sequences 5 and 6 in the video showed combustion of Paraffin wax B, a propellant according to the present invention. These two tests confirmed the firing capability of the method of the present invention at oxidizer mass flow rates higher than shown in Table 1. Figures E and F attached hereto are still frames from the video showing the plume generated during combustion for firing test sequences 5 and 6, respectively. As shown in Figures E and F, the plume is much larger than that achieved with the conventional methods of combusting.

Test firing sequences 7 and 8 shown in the video were recently conducted an experimental facility in Miami Florida.

For test sequence 7, an experimental hybrid rocket apparatus was used, having a finned large surface area port grain design. Figure G attached hereto is a still frame of the video showing a simplified schematic diagram of this finned design. Test firing sequence 7 in the video showed the

burning of hydroxyl terminated polybutadaiene (HTPB), a conventional propellant. The thrust of the rocket in this test 7 was approximately 800 lbs. Figure H attached hereto is a still frame from the video showing the plume generated during combustion for this firing test sequence.

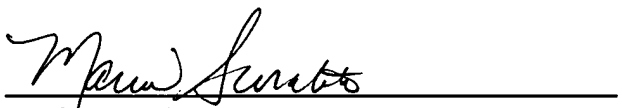
For test sequence 8, an experimental hybrid rocket apparatus was used, having a single circular port grain port grain design. Figure I attached hereto is a still frame of the video showing a simplified schematic diagram of this single circular design. Test firing sequence 8 in the video showed the combustion of Paraffin wax B according to the present invention. The thrust of the rocket in this test 8 was approximately 800 lbs. Figure J attached hereto is a still frame from the video showing the plume generated during combustion for this firing test sequence. Please note that the oxidizer mass flow rate (in this case N_2O) was the same in both test sequence 7 and 8.

The brief remainder of the video showed further tests of paraffin wax propellant at the Miami facility, and an ignition test at a new NASA Ames test facility, as well as still images of the NASA Ames facility.

If there is any discrepancy in this Interview Summary noted by the Examiner, Applicant requests that the Examiner call the Applicant's Attorney at the telephone number listed below. Based on the foregoing, Applicant respectfully submits that the application is now in condition for allowance. If any further matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. The Commissioner is authorized to charge any additional fees to Deposit Account No. 06-1300 (Order No. A-67587-1/AJT/MSS).

Dated: August 24, 2001

Respectfully submitted,



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